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INDIAN ROADS CONGRESS

BRIDGE LOADINGS ROUND THE WORLD

NEW DELHI
1966

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BRIDGE LOADINGS

ROUND THE WORLD

The Indian Roads Congress issued a questionnaire to various countries in the world about the bridge loadings applied for design purposes.

The following countries very kindly sent the replies:

(1) America (U.S. Bureau of Public Roads)

(2) Austria

(3) Belgium—see pp. 128-129

(4) Canada (Toronto and Ontario)

(5) Finland

(6) Germany (Federal Republic)

(7) Great Britain

(8) India

(9) Italy

(10) Japan

(11) Malaysia

(12) New South Wales (Australia)

(13) New Zealand

(14) Norway

(15) Philippines

(16) Rhodesia

(17) Sweden

(18) Switzerland

(19) Turkey

The ensuing Tables have been prepared from the information received.

The Indian Roads Congress is very grateful to the above mentioned countries for the information supplied.

<table>
<tr><th>QUESTIONS</th><th>AMERICA
(U.S. Bureau of Public Roads)</th><th>AUSTRIA</th></tr>
<tr>
<td>1. LOADINGS
(i) Design train loading truck loading or any special loading for each category of roads.</td>
<td>Article 1.2.5*
(i) Truck loading and lane loading H10-44, H15-44, H20-44, H15-S12-44, H20-S16-44 and Military loading. (See Figs. 1, 2, 3 & 4 in Plate I).

For trunk highways or other highways which carry heavy truck traffic, minimum loading H15-S12-44.

For Inter-state highway system, Military loading (see Fig. 4 in Plate I) wherever it causes moments or shear greater than those caused by H20-S16 truck or the standard lane loading.</td>
<td>
<table>
<tr><td>Bridge Classes</td><td></td><td>See Fig. 6 in Plate I</td><td></td><td></td></tr>
<tr><td>Total weight</td><td>tonnes</td><td>25</td><td>16</td><td>16</td></tr>
<tr><td>(a) Truck
Fore wheel</td><td>tonnes</td><td>4</td><td>2·5</td><td>2·5</td></tr>
<tr><td>Back wheel</td><td>tonnes</td><td>8·5</td><td>5·5</td><td>5 5</td></tr>
<tr><td>Equivalent weight</td><td>tonnes/m²</td><td>1·67</td><td>1·07</td><td>1·07</td></tr>
<tr><td>(b) Uniform load</td><td>tonnes/m²</td><td></td><td>0·50</td><td>0·40</td></tr>
<tr><td>(c) Caterpillar
Car
Total weight</td><td>tonnes</td><td></td><td>60</td><td>—</td></tr>
<tr><td>Caterpillar load</td><td>tonnes/m²</td><td></td><td>17·14</td><td>—</td></tr>
<tr><td>Equivalent weight</td><td>tonnes/m²</td><td></td><td>3·33</td><td>—</td></tr>
</table>
For spans more than 30 m, calculations may be made with the "Equivalent weight" (total weight, referred to the track area) instead of the different wheel loads.
</td>
</tr>
<tr>
<td>(ii) Distance between successive trains or loads
(a)
(b)
(c)
(d)
(e)</td>
<td>(ii) No successive trains or loadings.</td>
<td></td>
</tr>
<tr>
<td>2. Lateral disposition of train loading or other types of loadings with respect to :
(a) Kerb

(b) Central line of the bridge</td>
<td>Article 1.2.6*

(a) Distance from kerb to centre line of wheel—2 ft (for slab design—1 ft). (see Figs. 1 and 3 in Plate I).

(b) No particular lateral disposition.</td>
<td>(a) The standard trucks, 2·5 m wide, are equal to the width of a lane; therefore the trucks have to be put close together, so that the live load for the considered structural part arises to a maximum.
It is not necessary to shift the wheels of the trucks to the kerb.

(b) The caterpillar, as the only load on the roadway, has a maximum deviation of 0·5 m on both sides from the centre line of the roadway.</td>
</tr>
<tr>
<td>3. No. of train loadings taken for design of each span of bridges and culverts with the following number of traffic lanes :

(i) Two lanes

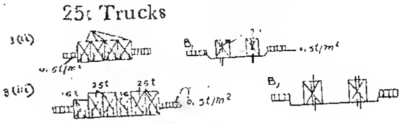
(ii) Two lanes each way on a divided highway

(iii) Three lanes each way on a divided highway</td>
<td>Articles 1.2.7, 1 2.8, 1.2.9*

(i) 100 per cent of either 2-lane loading or one standard H or H.S. truck per each lane.
(ii) 75 per cent of either 4 lane loading or one standard H or H.S. truck per each lane.
(iii) 75 per cent of either 6 lane loading or one standard H or H.S. truck per each lane.
Note : In case of a 3-lane bridge, 90 per cent of the full live load.</td>
<td>Bridge Class I : The calculation has to be executed for :
(A) on 2 adjoining lanes, 1 truck of 25 t each. On every other of the following lanes, 1 truck of 16 t. The rest of roadway and footpath to be covered with uniformly distributed load of 0·5 t per metre.

(B) For a caterpillar of 60 tonnes only, also see 2(b) above.

Bridge Class II : On 2 adjoining lanes, one 16 t truck each. The rest of the roadway and footpath to be covered with uniformly distributed load of 0.4 t per sq. metre.

60 t CATERPILLAR
25t Trucks
3 (ii)
3 (iii)

</td>
</tr>
</table>

*Articles referred to relate to the A.A.S. H.O. Standard Specifications for Highway Bridges (1961).

CANADA	FINLAND

TORONTO

Truck loading is based on the H20-S16-44 or the heavier H25-S20 loading in the A.A.S.H.O. Standard Specifications for Highway Bridges (1961).

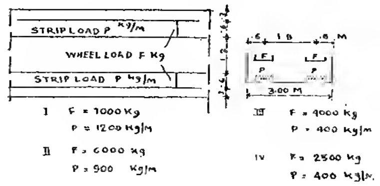
ONTARIO

All H20-S16-44

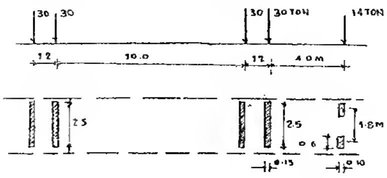
Article 1.2.4 to 1.2.9*

FINLAND

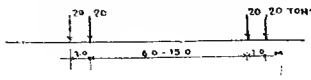
LANE LOAD



HEAVY TRUCK LOAD I



HEAVY TRUCK LOAD II



TORONTO

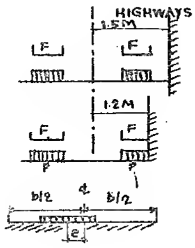
(a) For trucks, wheel is placed 2 ft away.

(b) No relationship for trucks.

ONTARIO

Article 1.2.6.*

FINLAND



With Impact

Without Impact

For Heavy Truck Load e⩽0.1 b

TORONTO

(i) 2 train loads.

(ii) (a) 2 train loads.
(b) 3 train loads with 10 per cent reduction.
(c) 4 train loads with 25 per cent reduction whichever gives the most critical stress.

(iii) As in (i) above except that (c) becomes 4 lanes or more with 25 per cent reduction.

ONTARIO

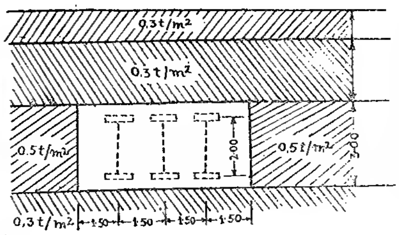
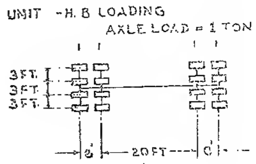
Article 1.2.9*

FINLAND

(i) 100 per cent

(ii) Two lanes 100 per cent, remaining lanes 50 per cent.

*Articles referred to relate to the A.A.S.H.O. Standard Specifications for Highway Bridges (1961).

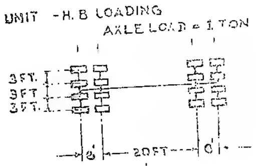
QUESTIONS	FEDERAL REPUBLIC OF GERMANY	GREAT BRITAIN
1. LOADINGS (i) Design train loading truck loading or any special loading for each category of roads.	 (i) For Federal Autobahns, Federal Highways and Rural Highways of 1st order, Bridge Class 60=6×10 t For Rural Highways of 2nd order and District Roads, Bridge Class 30=6×5 t For Minor Roads, Bridge Class 16 & 6, see Fig. 7 in Plate II.	Bridges carrying public roads are designed for HA loading (British Standard 153-Part 3-Section A—see Fig. 8 in Plate II consisting of a uniformly distributed load plus a single knife edge load. The U.D. load varies with the span but between 20 and 75 ft it is constant at 2200 lb per linear foot of 10 ft wide lane. The knife edge load is placed parallel to the supports of the member under consideration and has a value of 27,000 lb for a 10 ft wide lane. Bridges carrying important roads are checked for 45 units of HB loading to British Standard 153. 
(ii) Distance between successive trains or loads (a) (b) (c) (d) (e)		
2. Lateral disposition of train loading or other types of loadings with respect to : (a) Kerb	(a) For main carriageway, the load should be so placed as to cause worst effects. Laterally it can be placed upto the kerb.	(a) Any part of the bridge deck between kerbs, including the hard shoulder, if any, is deemed to be subject to HA or HB loading.
(b) Central line of the bridge	(b) Outside the carriageway, uniformly distributed load of 0·3 t per m² for bridges of class 60 and 30.	
3. No. of train loadings taken for design of each span of bridges and culverts with the following number of traffic lanes : (i) Two lanes (ii) Two lanes each way on a divided highway (iii) Three lanes each way on a divided highway	(i) & (ii) The portion of train loading according relieving effect will not be considered.	(i) Two lanes of HA loading or one lane of HB loading together with one lane of 1/3 HA loading. (ii) Two lanes of HA loading and two lanes of 1/3 HA loading or one lane of HB loading and the adjacent lane with 1/3 HA loading. The two lanes in the other carriageway each with HA loading. (iii) Two lanes of HA loading and four lanes of 1/3 HA loading or one lane of HB loading and the two adjacent lanes with 1/3HA loading. In the other carriagway, two lanes with HA loading and the other lane with 1/3 HA loading.

*Articles referred to relate

GREAT BRITAIN

idges carrying public roads are desi- for HA loading (British Standard 'art 3-Section A—see Fig. 8 in Plate II ;ting of a uniformly distributed load a single knife edge load. The U.D. varies with the span but between 20 '5 ft it is constant at 2200 lb per linear of 10 ft wide lane. The knife edge is placed parallel to the supports of the ber under consideration and has a of 27,000 lb for a 10 ft wide lane.

·idges carrying important roads are :ed for 45 units of HB loading to h Standard 153.



Any part of the bridge deck between kerbs, including the hard shoulder, if any, is deemed to be subject to HA or HB loading.

Two lanes of HA loading or one lane of HB loading together with one lane of 1/3 HA loading.

Two lanes of HA loading and two lanes of 1/3 HA loading or one lane of HB loading and the adjacent lane with 1/3 HA loading. The two lanes in the other carriageway each with HA loading.

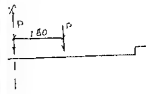
Two lanes of HA loading and four lanes of 1/3 HA loading or one lane of HB loading and the two adjacent lanes with 1/3HA loading. In the other carriagway, two lanes with HA loading and the other lane with 1/3 HA loading.

INDIA	ITALY
Clauses 201* and 207* (i) Class "AA" tracked vehicle and Class "AA" wheeled vehicle. Class "A" train of vehicles. Class "B" train of vehicles. (See Figs. 9, 10 & 11 in Plate III) (a) For every 2-lane width of bridge Class "AA" one tracked or wheeled vehicle or two lanes of Class "A" loading whichever creates worst effects, to be used for road bridges in municipal limits, industrial and other specified areas and on specified highways. (b) Class "A" to be used for all roads on which permanent bridges and culverts are constructed. (c) Class "B" for temporary bridges, etc. (ii) See Figs. 9, 10 & 11 in Plate III For Class "AA" tracked vehicles—300 ft min. For Class "A" train of vehicles—65 ft min. For Class "B" train of vehicles—65 ft min.	For the purpose of loading, highways are divided into the following two categories. : (I) Highways for civil and military use, and (II) Highways for civil use only (local and minor roads). Loading system. Type 1. a continuous train of 12 t truck ,, 2. a single 18 t steam roller ,, 3. a crowd load of 400 kg per sq. m. ,, 4. a continuous train of military loads of 61.5 t ,, 5. a continuous train of military loads of 32 t ,, 6. a single military load of 74.5 t (See Fig. 13 in Plate—IV) Loading system to be adopted in the design of highway bridges. Category (I)—One military type-the heaviest of types 4, 5 or 6 flanked by one or more trains of truck (Type 1) with crowd loading of 400 kg/m² (Type 3) on the footpaths. Category (II)—The most unfavourable of the following conditions : (a) one or more lanes loaded with continuous trains of trucks (Type 1) with crowd loading on the footpaths (Type 3) (b) one or more steam rollers (Type 2) side by side with crowd loading on footpaths (Type 3).
Clause 207* (See Figs. 9 to 11, Plate III) (a) Class "AA" clear distance between kerb and outer edge of wheel or track=1ft for single lane bridge with 12 ft carriageway; 2 ft for multi-lane bridge with less than 18 ft carriageway; 4 ft for 18 ft or above carriageway: In case of Class "A"—clear distance 6 in. between kerb and wheel having 20 in. width for all carriageway widths. Class "B" 6 in. for wheel having 15 in. width. (b) Not given.	No details given.
Clauses 113* and 208.2* (i) One train of Class "AA" tracked or wheeled vehicles or two lanes of Class "A" train of vehicles for National Highways and State Highways. (ii) 80 per cent of two trains of Class "AA" tracked or wheeled vehicles or of four lanes of Class "A" train of vehicles. (iii) This type of bridge construction is not permitted.	No details given.

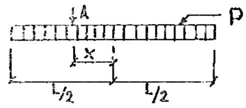
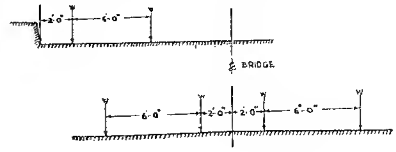
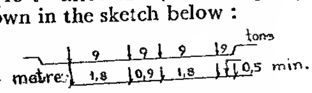
*Clauses referred to relate to the Indian Roads Congress Standard Specifications & Code of Practice for Road Bridges-Sections I & II (1964).

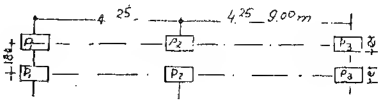
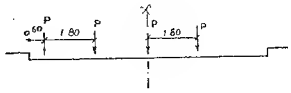
KEY

	P1 (t)	P2 (t)
	8	8
5	6	6
	4	0



each lane.

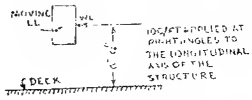
NORWAY	PHILIPPINES	RHODESIA
Equivalent loading per lane :  $A = 12 + 8x/L$ tons (Class I & II) Class I : $p = 0{\cdot}5 + \frac{35}{L+5}$ Class II : $p = 0{\cdot}35 + \frac{24}{L+7}$ tonnes per linear metre of lane. Impact included in A and p. L=actual loaded length of lane. Class I and II mainly refer to lane widths for two lane bridges usually used for roadway widths more or less than 6·5 metre respectively.	Class of bridge loading. AA—H20 or H20-S16, A—H15 or H15-S12, B—H10 — See Figs. 1, 2, 3 in Plate I & Fig. 14 in Plate IV. Class "AA" bridges for specially heavy traffic units in locations where the passage of such loads is frequent or located in large cities and industrial centres. Class "A" bridges for normally heavy traffic units and the occasional passage of specially heavy loads. Class "B" bridges for light traffic units and the occasional passage of normally heavy loads. Class "B" bridges shall be considered as temporary or semi-temporary structures. There is also loading H-10-35 as given in Fig. 14 in Plate IV. 	HA loading, supplemented with 30 units HB loading allowing 25 per cent increase in permissible working stresses. See Fig. 8 in Plate II for HA loading. For HB loading, see sketch under Great Britain p. 98. All in accordance with B.S. 153/1954 Part 3—Section A.
The above lane loadings are normally considered uniformly distributed over lane widths from 3·0 to 3·75 metre. Besides, the structure is designed for a local loading of two axles of each 18 t (13 t allowable+5 t impact) with lateral position shown in the sketch below : Furthermore, the structure is controlled for one up to 30 metre long Class II lane load laterally distributed as the above two right wheel loads (or a corresponding other position, if more unfavourable). 	Similar to A.A.S.H.O. Article 1.2.4. Figs. 1 and 3 in Plate I.	(a) 18" from kerb in any analysis not incorporating a lateral distribution analysis. Accidental loading of a 4 ton wheel is investigated at edge of parapet, allowing 25% increase in permissible working stresses. (b) Symmetrical, unless a lateral distribution analysis is undertaken.
(i) The above equivalent loading in each lane. (ii) -do- -do- (iii) The full equivalent loading in two lanes, 50 per cent in the third lane.	(i) Two headed in the same direction (ii) Two each way (iii) Three each way (load intensity reduced to 90 per cent)	(i) Full HA loading in each lane. (ii) As above. (iii) N/A. (iv) Three lanes. HA loading in two adjacent lanes, 1/3 HA in third lane.

SWEDEN	SWITZERLAND	TURKEY
See Fig. 15 in Plate IV (a) Lane loading consisting of one 14 t axle load + distributed "p" t/m, when $p=2{\cdot}4$ t/m for loaded length less than 10 m, and $1{\cdot}1$ t/m for loaded length over 90 m. For loaded length between 10 m and 90 m, "p" varies according to formula $p=2{\cdot}4-\frac{1{\cdot}3}{80}(l-10)$ where l is the loaded length in metres (distance between the zero points of influence curve) or by interrupted loading, the sum of loaded lengths and length of the unloaded parts between. (b) Single truck loading of 100 t. This single truck loading may be assumed as exceptional loading without concurrent loading stress increased by 15 per cent. On special roads, it can be prescribed that the above mentioned single truck shall be considered as normal traffic loading.	(i) Main roads : Distributed load of 360 kg per m^2 and one axle load of 15 t for each lane. Secondary roads : The same with 240 kg per m^2 and 10 t. (ii) Instead of distributed loading with one axle load, all parts should be checked also for the following train load : 3 axle loads for each lane with $1{\cdot}5$ m distance behind each other of 15 t for main roads, 10 t for secondary roads.	 P_1 (t) P_1 (t) P_3 (t) e (cm) State Roads H20-S16 2 8 8 51 Provincial Roads H15-S12 $1{\cdot}5$ 6 6 38 Village Roads H10 1 4 0 25
See Fig. 15 in Plate IV.	The distributed load goes all over the bridge. The train and axle loads in the position which gives the maximum stress.	
(i) Two lane loading or single truck loading. (ii) Each side of the divided highway shall essentially be regarded as belonging to a separate bridge. However, in some cases on long bridges, certain deduction in the loading is often allowed.	(i) Not more as two lanes are loaded with axle or train loads. (ii) & (iii) Not more as two lanes each way have to be loaded with axle or train loads.	One truck for each lane.

QUESTIONS	AMERICA (U.S. Bureau of Public Roads)	AUSTRIA	CANADA
4. Area of the train of vehicle assumed in elevation for calculating the effective wind pressure.	Article 1.2.14* Wind pressure at the rate of 100 lb per linear ft on moving live load acting at 6 ft above deck. This is to be taken only for group loading combination as explained in Article 1.4.1*.	The Austrian standards adopt a 2·5 m high rectangular traffic area in correspondence with the position of live load.	**TORONTO** A simplified procedure is used for spans 125 ft and under. 100 lb per linear ft transversely. 40 lb per linear ft longitudinally. Both forces applied simultaneously 6 ft above deck. **ONTARIO** Article 1.2.14*
5. Impact factor due to live loads assumed for different types of loads on : (i) Concrete bridges	Article 1.2.12* Impact fraction $I=\frac{50}{L+125}$ (maximum impact factor 30 per cent) L=length in ft of the portion of the span which is loaded to produce the maximum stress in the member. This is applicable only for structural members of group (A).	Impact Factor (i) Concrete bridges : L=span of the structural part (metre) 0 10 30 50 70 Platform girder, direct loaded main girder 1.40 1.30 1.20 1.10 1.00 Indirect loaded main girder 1.40 1.25 1.10 1.00 1.00 Floor slab 1.40	**TORONTO** (i) Concrete bridges—30 per cent
(ii) Steel bridges	No distinction has been made in impact factor for different types of loads or bridges of different materials.	(ii) Steel bridges : L in metres 2 4 6 8 10 20 Impact factor Lane I 1.64 1.50 1.41 1.35 1.30 1.18 Lane II 1.32 1.25 1.20 1.17 1.15 1.09	(ii) Steel bridges—30 per cent
(iii) Prestressed concrete bridges Variation of impact according to span length.	For further explanation, see Article 1.2.12*.	L in metres 40 60 80 100 Impact factor Lane I 1.1[illegible] 1.07 1.05 1.04 Lane II 1.05 1.03 1.02 1.02 For all following lanes : Impact factor=1	(iii) Prestressed concrete bridges—30 per cent **ONTARIO** Article 1.2.12.*

*Articles referred to relate to the A.A.S.H.O. Standard Specifications for Highway Bridges (1961).

FINLAND	FEDERAL REPUBLIC OF GERMANY	GREAT BRITAIN	TURKEY
Height 2 m for the length of loading.	For bridges without load—250 kg/m^2 For bridges under construction—125 kg/m^2 For bridges with load —125 kg/m^2 For pedestrian & cycle bridges—75 kg/m^2 The above loading acting in case of (a) road bridges at 2.0 m height (b) pedestrian bridges at 1.8 m height.	A plane with a continuous height of 8 ft above the carriageway for highway bridges or 4 ft above the footway for foot-bridges. Allowance may be made for the screening effect of the structure on the plane, based on projected areas.	Effective wind pres- ıre is calculated as ıllows : 'or unloaded bridge : 5 times the height f the full area of the ridge deck including ıe hand-rails. Load 50 kg per m^2. 'or loaded bridges : eight of the area f the bridge deck levation+2·0 m for ve load. Vind load 125 kg er m^2.
I=40 per cent when filling h(m) $\geqslant$3 m I=16 (3·0−h) per cent for height of fill varying from 0·5—3·0m For timber bridges always I=20 per cent.	Impact Factor $\varphi = 1{\cdot}4 - 0{\cdot}008 \times l\varphi \geqslant 1.0$ $l\varphi$=governing length in metres (See D.I.N. 1073, 1074, 1075 and 1078 for the determination of the value of $l\varphi$).	HB loading has no impact factor. HA loading incorporates an impact factor of 25 per cent on the heaviest axle in the train of vehicles from which HA loading is derived. It is constant for all forms of construction.	$p = 1 + \frac{15}{L+37}$ here L=span length in metres. $p_{max.} = 1{\cdot}3$

QUESTIONS	NEW SOUTH WALES	NEW ZEALAND	NORWAY	PHILIPPINES
4. Area of the train c vehicle assumed i elevation for calcu lating the effectiv wind pressure.	Clause 2·15* Lateral wind force at 100 lb per linear ft acting at a height of 6 ft above the deck. Alternatively, 66 lb per linear foot laterally plus 33 lb per linear foot longitudinally acting simultaneously.	Wind loads as per A.A.S.H.O. Specifications for longitudinal elevation. See Fig. 3 in Plate I and sketch in Q. 1, p. 101.	Normally no wind pressure is considered on loaded bridge. On bridge without load, wind pressure is assumed equal to 250 kg per m^2 of exposed area.	 See Figs. 1,2 and 3 in Plate I.
5. Impact factor du to live loads assum ed for differen types of loads on : (i) Concrete bridges (ii) Steel bridges (iii) Prestressed concrete bridges Variation of impac according to span length.	Clause 2·13* (a) Impact=10 per cent for steel or concrete substructure above the foundations but not rigidly connected to the superstructure and structures carrying $1\frac{1}{2}$ to 3 ft of fill. (b) Steel or concrete superstructures and those parts of steel or concrete substructure above the foundations which are rigidly connected to the superstructure as in the rigid frames or continuous designs and structures carrying less than $1\frac{1}{2}$ ft of fill. The impact shall be $I=\frac{5000}{L+125}$ per cent (max. 30 per cent) (min. 10 per cent)	Impact factor not dependent on bridge type. Impact factor in use : $I=\left(\frac{50}{L+125}\right)\times 100$ per cent	Impact is included under Q. 1—equivalent loading. The local loading (Q. 2) assumes 5 t impact for an allowable 13t axle load (38·5 per cent) Allowable gross weights of vehicles are established by comparing their effect with the effect of the class II equivalent loading. By this, the above 38·5 per cent impact is added to the heaviest axle, but it is so far considered unnecessary to add impact to the remaining axles.	For all kinds of bridges, $I=\frac{50}{L+125}$ in which I=impact fraction (maximum 30 per cent) L=length in feet of the portion of the span which is loaded to produce the maximum stress in the member.

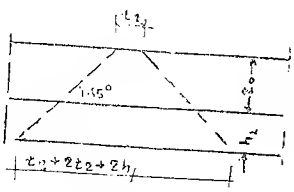
*Articles referred t

*Clauses referred to relate to Highway Bridge Design Specifications of N.A of A.S. Road Authorities (1965).

RHODESIA	SWEDEN	SWITZERLAND	TURKEY
As under Section 12—B.S. 153/1954—Part 3, Section "A".	The wind pressure area of traffic load shall supposed to be a rectangle 2 metre higher from the deck and length equal to loaded length.	For road bridges, 3 metre high band is assumed.	Effective wind pressure is calculated as follows : (a) for unloaded bridge : 1·5 times the height of the full area of the bridge deck including the hand-rails. Load 250 kg per m^2. (b) for loaded bridges : height of the area of the bridge deck elevation + 2·0 m for live load. Wind load 125 kg per m^2.
(i) & (ii) Concrete and steel bridges—Included in HA loading. See B.S. 153/1954. (iii) For Prestressed concrete bridges : As above, but for dynamic stability the following apply : (a) The vertical acceleration of the superstructure under $\frac{1}{2}$ HA loading, travelling at 40 m.p.h. shall not exceed 0·5 ft per sec^2. (b) The natural frequency of the superstructure under a live load of 100 lb per sq. ft. shall not be less than 3 cycles/sec., where the natural frequency equals $0{\cdot}75\sqrt{\frac{EI}{wL^4}}$ cycles/sec. where "E" is Young's Modulus for the superstructure in lb per sq. in., "I" moment of inertia of superstructure (in.^{4}). $w = B \times 100 +$ weight of superstructure in lb/ft run. "B" = breadth of superstructure. "L" = span of superstructure in feet.	40 per cent for lane loading and only for the wheel loads, and not for the uniform load p. When wheel is in contact with railing or another limitation (kerb, etc.) of the roadway, no impact allowance has to be considered. No impact for single truck loading.	$\text{Impact} = 5 \times \frac{100+L}{10+L}$ where L is the length of span in m.	$\phi = 1 + \frac{15}{L+37}$ where L = span length in metres. $\phi_{max.} = 1{\cdot}3$

QUESTIONS	AMERICA (U.S. Bureau of Public Roads)	AUSTRIA	CANADA
6. Ground Contact Area The shape of contact area for design calculations and formulae adopted for dispersion of the wheel loads through the wearing coat and the slab for designing.	Article 1.2.6 and 1.3.2 (c) As per Figs. 1 and 3 in Plate I. For further details, see Article 1.3.2 (c).	For the shape of the contact area, see Q. 1, Loadings. If there is a load distributing layer, concentrated loads may be dispersed under an angle of 45 degrees. The dispersion may be extended to the centroidal axis of the considered structural part only.	**TORONTO** Shape is circular for slabs on soil. Otherwise dispersion is in accordance with "Standard Specifications for Highway Bridges" (A.A.S.H.O.—1961). **ONTARIO** Article 1.3.2*
7. Equivalent UDL or knife edge loading, if adopted for working out : (i) Bending moment. (ii) Shear.	Articles 1.2.7 and 1.2.8* See Fig. 2 in Plate I.		**TORONTO** (i) For bending moment 640 lb per linear ft UDL+18000 lb (in lieu of H20–S16 truck) (ii) For shear 640 lb per linear ft UDL+26000 lb (in lieu of H20–S16 truck) **ONTARIO** None
8. The percentage of the live load on the bridge taken for calculating the braking force in the design of substructure of the bridge.	Article 1.2.13* 5 per cent of L.L. without impact in all lanes carrying traffic headed in the same direction acting at 6 ft above deck. The load shall be lane-load plus knife edge load without impact and reduction as per Q. 3 applied. Longitudinal forces due to friction of beams shall also be provided for in the design.	30 per cent of the weight of the heaviest vehicle (caterpillars excluded).	**TORONTO** 5 per cent **ONTARIO** Article 1.2.13*

*Articles referred to relate to the A.A.S.H.O. Standard Specifications for Highway Bridges (1961).

FINLAND	FEDERAL REPUBLIC OF GERMANY	GREAT BRITAIN
	For ground contact area of wheel load, see Fig. 7 in Plate II. Generally the dispersion of wheel load be taken at 45 degrees. In the case of massive slabs, the dispersion as above will be up to the middle of the slab.	The contact area for a heavy wheel of 11¼ tons in the HB loading is taken as 15 in.×3 in. with the 3 in. in the direction of travel. This load may be dispersed through the wearing course and slab at an angle of 45 degrees longitudinally and transversely. For structural distribution in a slab, normal structural theory may be used, *e.g.*, Pigeaud or Westergaard.
See Q. I		See Q. 1.
20 per cent	100 per cent	The longitudinal force for HA loading is 10 Tons for spans up to 10 ft, plus 0·5 Ton per foot of span over 10 ft with a maximum of 25 Tons. The longitudinal force for 45 units of HB loading is 45 Tons for all spans.

KEY

ıent perpendicular to

rom 0·6 to 2·0 m

+0·76

n E=0·4S+1·14

ːment parallel to traffic

75S+0.98

ıe :

q t/m)	Q(t) Moment	shear
1.00	9.00	13.00
0.75	6.75	9.75
0.50	4.50	6.50

nt of one standard the whole width ıidge applied on ıce of the deck.

QUESTIONS		INDIA	ITALY
6. Ground Contact Area The shape of contact area for design calculations and formulae adopted for dispersion of the wheel loads through the wearing coat and the slab for designing.	A P F A	Clauses 207 and 207·2.* See Figs. 9, 10 and 11 in Plate III, for shape of contact areas. For one way slab dispersion=effective width measured parallel to the supported edges : $e=kx\left(1-\frac{x}{l}\right)+W$ and $e=1{\cdot}2x+W$ for cantilever. Effective dispersed length of slab (in the direction of span)= dimension of tyre contact area in the direction of span+twice the thickness of slab and wearing coat. For two way slabs, dispersion as per rational method.	In slab calculations, the weight of a rear wheel (6t) of the roller is distributed over a rectangle, one side of which is equal to the sum of the width of the roller wheel plus twice the depth of slab and wearing coat; the other side is equal to 10 cm plus twice the depth of slab and wearing coat. For the bridge on highway of category I, an additional calculation must be made in respect of the two rear axles, each of 18t, of load in Type 6. In such a case, the total load of the two axles must be distributed over a rectangle with sides of 2.65×1.12m each side being increased by twice the depth of slab and wearing coat. Normally the calculation is carried out for a slab When the lengths of the sides differ substantially, the slab can be considered as being bound by the longer sides, increasing the rectangular distribution in the direction of those sides by one half of the shorter side. **On main beams** In considering transverse distribution, the loading should be so placed as to give the most unfavourable effects. In the case of beam and slab construction, if a rigorous calculation is not made based on the theory of slabs, then all the beams should be similar and designed to carry the increased edge stresses.
7. Equivalent UDL or knife edge loading, if adopted for working out : (i) Bending moment. (ii) Shear.	Arti. See	Nil	See Table 2 page 131
8. The percentage of the live load on the bridge taken for calculating the braking force in the design of substructure of the bridge.	Articl 5 per out im carryi in the acting The lo load pl withou reducti applied forces c beams vided f	Clause 214·2* (a) 20 per cent of the first train load plus 10 per cent of the loads of succeeding trains or part thereof, the train loads in one lane only being considered for this purpose. When only part of the first train is on the full span, the braking force shall be only 20 per cent of portion of load on the span. (b) For bridges having more than two lanes : as in (a) above for the first two lanes plus 5 per cent of the loads on the lanes in excess of two. (Effect of impact is not taken into consideration).	Braking force shall be equal to 1/10 of the load superimposed by a continuous train of trucks (Type 1). This force, however, shall not be less than 0·3 of the heaviest axle of the load system being considered.

*Articles referred to relate to the

*Clauses referred to relate to the Indian Roads Congress Standard Specifications and Code of Practice for Road Bridges—Sections I and II (1964).

JAP

Front Wheel

Rear Wheel

10

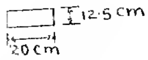
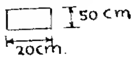
ght of a rear wheel
d over a rectangle,
ıe sum of the width
the depth of slab
ıe is equal to 10 cm
ıd wearing coat.
ay of category I, an
made in respect of
t, of load in Type 6.
oad of the two axles
ectangle with sides of
increased by twice
coat.
carried out for a slab
s differ substantially,
being bound by the
rectangular distribu-
sides by one half of

distribution, the load-
ıs to give the most

d slab construction, if
ot made based on the
beams should be simi-
the increased edge

equal to 1/10 of the load
ıtinuous train of trucks
owever, shall not be less
t axle of the load system

s Standard Specifications
l II (1964).

JAPAN	MALAYSIA
Front Wheel  Rear Wheel 	B S. 153 : Part 3A : 1954 Appendix A 1(c) and 3(f) Contact area of 15 in.×3 in., the smaller dimension being in the direction of travel. Dispersal under the wheel load shall be taken at 45 degrees.
For bridges with span length less than 150 m, it is not adopted. For longer spans, equivalent U.D.L may be specified.	B.S. 153 : Part 3A : 1954 Appendix A. See Fig. 8 in Plate II.
10 per cent of T loading.	B.S. 153 : Part 3A : 1954 Clause 10 Span upto 10 ft=10 Tons Span above 10 ft=10 Tons+ ½ Ton for each ft of span over 10 ft, but not exceeding 25 Tons.

TURKEY

nforcement perpendicular to

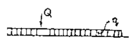
ı (S) from 0·6 to 2·0 m

=0·6S+0·76

an 2 m E=0·4S+1·14

ıforcement parallel to traffic

=0·175S+0.98



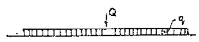
ne :

(q t/m)	Q(t) Moment	shear
1.00	9.00	13.00
0.75	6.75	9.75
0.50	4.50	6.50

nt of one standard
the whole width
idge applied on
ıce of the deck.

QUESTIONS	NEW SOUTH WALES	NEW ZEALAND	NORWAY	PHILIPPINES
6. Ground Contact Area The shape of contact area for design calculations and formulae adopted for dispersion of the wheel loads through the wearing coat and the slab for designing.	Clause 2·5* See Figs. 1 & 3 in Plate I. Contact width of each rear tyre equals 1 inch per every 2000 lb of total weight of loaded truck.	The shape of contact area as per A.A.S.H.O. H20-S16-44 loading. Distribution according to the A.A.S.H.O. Specification based on Westergaard method.	The contact area for the wheel load given under Q. 2 is 50 cm lateral, by 20 cm in driving direction. For moment calculation, the above area is increased by thickness of wearing coat+50 per cent of slab thickness in each direction.	See Figs. 1 an in Plate I and a Article 1.3.2 (c A.A.S.H.O. Bri Specifications (19
7. Equivalent UDL or knife edge loading, if adopted for working out : (i) Bending moment. (ii) Shear.	Clause 2·5* See Fig. 2 in Plate I Worked out bending moment and shear for various spans is given in Appendix A (pages 172-183) of NAASRA Highway Bridge Design Specifications (1965).	As per A.A.S.H.O H20-S16-44 Lane Loading.	See Q. 2 above. For shear, the actual knife edge load "A" reaches the max. value of 16 tonnes according to formula $\left(x = \frac{L}{2}\right)$	Similar to A.A.S.H.O. Bridge Specifications (1961). Fig. 2 in Plate I.
8. The percentage of the live load on the bridge taken for calculating the braking force in the design of substructure of the bridge.	Clause 2·14* 5 per cent of total live load (without impact) on the bridge loaded to give maximum effect. This shall be taken as acting 6 ft above road level.	None in the case of road bridges.	So far braking force of 8 t for lane lengths upto 5 m increasing to 12 t for 25 m length or more has been adopted. At present the question of increasing braking forces is being considered.	5 per cent of the total lane loading for moment without impact and traffic headed in the same direction subject to reduction in the load intensity as follows : One or two lanes 100 per cent Three lanes 90 per cent Four lanes or more 75 per cent

*Clauses referred to relate to Highway Bridge Design Specifications of N. A. of A. S. Road Authorities (1965).

PHILIPPINES	RHODESIA	SWEDEN	SWITZERLAND	TURKEY
See Figs. 1 and in Plate I and als Article 1.3.2 (c) c A.A.S H.O. Bridg Specifications (196	Ellipitical, major axis 21 in., minor 9 in. Pigeaud's general dispersion, i.e., 45 degrees from contact area to main reinforcement in structural member.	Shape of contact area—See Fig. 15 in Plate IV.	—	Main reinforcement perpendicular to traffic : Slab span (S) from 0·6 to 2·0 m E=0·6S+0·76 Bigger than 2 m E=0·4S+1·14 Main reinforcement parallel to traffic E=0·175S+0.98
Similar to A.A.S. H.O. Bridge Specifications (1961). Fig. 2 in Plate I.	(i) N/A (ii) N/A	See Fig. 15 in Plate IV.	—	 For each lane : — (q t/m) — Q(t) Moment shear H20-S16 — 1.00 — 9.00 — 13.00 H15-S12 — 0.75 — 6.75 — 9.75 H-10 — 0.50 — 4.50 — 6.50
per cent of the otal lane loading or moment without npact and traffic eaded in the same irection subject to eduction in the load tensity as follows : ne or two lanes 100 per cent hree lanes 90 per cent ur lanes or more 75 per cent	See para 10 B. S. 153 (1954) Part 3 Section "A".	Irrespective of the clear width of the roadway, the braking force shall be 7 tonnes for 20 m length & 12 tonnes per 30 m length or more uniformly distributed over the clear width of roadway. For intermediate lengths, linear interpolation is applied.	—	15 per cent of one standard truck for the whole width of the bridge applied on the surface of the deck.

of N. A. of A. S.

QUESTIONS	AMERICA (U.S. Bureau of Public Roads)	AUSTRIA	CANADA	FINL
9. The surcharge effect considered in the design of abutments of the bridge due to the live load on the approach fill.	Article 1.2.19* Surcharge effect on the abutment due to the live load on approach fill=2 ft. No sucharge, if adequately designed R.C.C. approach slab is provided.	No special standards.	**TORONTO** Equivalent to an additional 2 ft of backfill. **ONTARIO** 2 ft surcharge without approach slab. None if approach slab is used.	$\frac{1}{12}$F + n kg per n kg n kg per 2. 1.
10. Footpath loading (state) min. width of footpath acceptable.	Article 1.2.11 (c)* No minimum width of footpath.	Minimum width =1·50 m	**TORONTO** Normal use-100 lb per sq. ft.	num wi
(i) Crowd load assumed per sq. ft.	(i) 85 lb per sq. ft. for slab, stringers and immediate supports.	Bridge Class I =0·5 t per m^2 Bridge Class II =0·4 t per m^2		0 kg per
(ii) Any variation in the above load for change in the span length.	(ii) For girders, trusses, arches, etc. 0—25 ft span —85 lb/sq. ft. 26—100 ft span —60 lb/sb. ft. Over 100 ft span, $P=\left[30+\frac{3000}{L}\right]\left[\frac{55-W}{50}\right]$ where P=L.L. per sq. ft. (max. 60 lb per sq. ft.) L=loaded length of side-walk in feet. W=width of side-walk in ft	Nil	Nil	—
(iii) Any special loading specified for the accidental mounting of vehicles on the footpath and in that case overstressing, if any, allowed.	(iii) No such loading.	One truck of 25 tonnes (16 tonnes) placed to produce maximum stress. No overstressing allowed.	Not definite. **ONTARIO** Article 1.2.11*	: whe g : e & re

*Articles referred to relate to the A A.S.H.O. Standard Specifications for Highway Bridges (1961).

)A	FINLAND	FEDERAL REPUBLIC OF GERMANY	GREAT BRITAIN	)	TURKEY
n additional e without ach slab is	$\frac{1}{12}F + \frac{2}{3}P$ n kg per m^2 n kg n kg per m 2. 1.	Earth surcharge and earth pressure are determined from the characteristic value of the soil at site. The traffic load considered in the design of bridge should be placed at the unfavourable positions. Individual loads can be substituted by uniformly distributed loading.	The surcharge effect is taken as being equivalent to two feet height of fill.		0·80 m extra height of earth fill.
0 lb per sq. ft.	mum width=1·5 m		80 lb per sq. ft.; minimum width normally accepted is 6 ft.		Minimum width—0·75 m
	0 kg per m^2	(i) 0·5 t per m^2 in case of spans less than 10 m	100 lb per sq. ft.	360 ls...	(i) 300 kg per m^2 (for spans upto 30 m)
l	—	(ii) 0·550—0·005L $\geqslant$ 0·4 t per m^2 L=span in metre	These loadings may be reduced in the same proportion as the uniformly distributed load in HA loading, for spans above 75 feet.		(ii) $p=\left(0{\cdot}3+\frac{0{\cdot}9}{L}\right)\left(5{\cdot}5-\frac{W}{3}\right)$ (t per m^2) for spans bigger than 30 m L=span length in m. W=footpath width in m
e.) .11*	wheel load F (See g: e & reinf. 65 per cent Yield point	(iii) No	A four ton wheel load occupying a 12-in. diameter circle. 50 per cent overstress is permitted.	oad g)	

(1961).

QUESTIONS	(U
9. The surcharge effect considered in the design of abutments of the bridge due to the live load on the approach fill.	Art Sur- abu loac ft. No atel app ed.
10. Footpath loading (state) min. width of footpath acceptable.	Arti No foot
(i) Crowd load assumed per sq. ft.	(i) slab mec
(ii) Any variation in the above load for change in the span length.	(ii) 26 (P=[wher P=L 6 L=l s W=
(iii) Any special loading specified for the accidental mounting of vehicles on the foot-path and in that case overstressing, if any, allowed.	(iii) :

*Articles referred to relate to t

NEW ZEALAND	NORWAY	PHILIPPINES
When highway traffic can come within a distance from the top of the structure equal to one half the height, the pressure shall have added to it a surcharge pressure equal to not less than 2 ft of filling.	Usually a surcharge of 2 t per sq. metre has been considered for abutment design. A differentiation between low and high abutments ought to be introduced.	2 ft L.L. surcharge added to earth press
Minimum width 4 ft	For design of footpath structures : 400 kg per m^2	Minimum width—2 clear.
(i) 60 lb per sq. ft. (50 per cent of this when combined with main traffic live loads).	(i) Contemporary foot-path loading and local load according to Q. 2 200 kg per m^2 footpath.	(i) 85 lb per sq. ft
(ii) No	(ii) Contemporary foot-path loading and equivalent loading according to Q. 1 : $0{\cdot}1 \times P$ per sq. metre foot-path and not more than 200 kg per m^2.	(ii) Spans upto 0- 85 lb per sq. f Spans from 2 100 ft—60 lb p Over 100 ft sp $P = \left(30 + \frac{3000}{L}\right)($ P=L.L. per sq. ft. (maximum 60 lb p L=loaded length walk in ft W=width of side-
(iii) No allowance	(iii) Control for a "run-way" wheel of 6·5t (without impact) placed with its contact area close to railing. 50 per cent overstressing permitted.	(iii) Concentrated load of 15600 one foot from of rail. Stress fs=30000 p fc= 1670 p N= 10

See B S

Calcu struct Civil Practi Retai issued Struct Lond

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(i) 8

(ii) C B P

(iii) A a ti p p p st

PHILIPPINES	RHODESIA	SWEDEN	SWITZERLAND	TURKEY
ft L.L. surcharge lded to earth press	See clause 1·4 B S. 153/1954 Part 3 Calculations of forces on structures, page 16 et. seq. Civil Engineering Code of Practice No. 2 (1951)"Earth Retaining Structures" issued by the Institution of Structural Engineers, London.	1·5 t per m^2 each lane of 3 m width. For more than 2 lanes, the surcharge may be reduced in the same proportion as the loading, i.e. for more than two lanes, only 50 per cent extra lanes is to be added. This surcharge may be considered uniformly distributed over the width of abutment.	2 tonnes per m^2	0·80 m extra height of earth fill.
Minimum width—2 clear.	Minimum width 2 ft 6 in.	Minimum width—1·5 m. Separate footpath		Minimum width—0·75 m
(i) 85 lb per sq. ft	(i) 80 lb per sq. ft.	(i) 400 kg per m^2 uniformly distributed when loaded length exceeds 10 m. The above mentioned load be reduced for main girders and arches to 1/6 pt. per m^2 P=uniform lane loading as per Fig. 15 in Plate IV.	(i) Main roads..... 360 kg per m^2 Secondary roads... 240 kg per m^2	(i) 300 kg per m^2 (for spans upto 30 m)
(ii) Spans upto 0- 85 lb per sq. ft Spans from 2 100 ft—60 lb p Over 100 ft sp $P=\left(30+\frac{3000}{L}\right)($ P=L.L. per sq. ft. (maximum 60 lb p L=loaded length walk in ft W=width of side-	(ii) Clause 4C, B.S. 153/1954 Part 3 Section A		(ii) No	(ii) $p=\left(0{\cdot}3+\frac{0{\cdot}9}{L}\right)\left(5{\cdot}5-\frac{W}{3}\right)$ (t per m^2) for spans bigger than 30 m L=span length in m. W=footpath width in m
in- ·5t ced rea per ing (iii) Concentrated load of 15600 one foot from of rail. Stress fs=30000 p fc= 1670 p N= 10	(iii) Accidental loading of a 4 Ton wheel is investigated at edge of parapet, allowing 25 per cent increase in permissible working stresses.	(iii) Single axle load of 14 t (without impact) placed near the railing. For dead load plus single axle load of 14 t the stressess allowed may not exceed lower yield point of steel and 1/2 cube strength of concrete respectively.	(iii) Single wheel load of 6 tonnes (No over stressing)	

QUESTIONS	AMERICA (U.S. Bureau of Public Roads)	AUSTRIA	CANADA
11. Foot bridges. (i) The minimum width of foot bridge acceptable.	Article 1.2.11* (i) No such minimum widths specified.	(i) No standard dimensions.	**TORONTO** (i) Variable
(ii) The loading specified in the design of the deck in (a) Urban areas (b) Rural areas	(ii) No distinction made.	(ii) Austrian standards assume no different loads for rural and urban areas. Bridge class I—uniform load of 0·5 per t m^2. Bridge class II—uniform load of 0·4 t per m^2	(ii) Urban areas and Rural areas } 100 lb per sq. ft.
(iii) Loading stipulated for the design of hand-rails.	(iii) See Fig. 5 in Plate I.	(iii) 0·08 t per m on the upper edge of the hand-rail in horizontal and vertical direction.	(iii) No definite specification **ONTARIO** (i) As required (ii) Article 1.2.11* (iii) 1.2.11 revised interim (1964)
12. Any formulae stipulated for calculating the impact on piers and abutments due to floating objects in the river (i) floating timber	Article 1.2.17* (i) No details given.		**TORONTO** (i) & (ii) None since Canada's climate dictates that ice is normally critical.
(ii) vessels and small river craft	(ii) No details given.		
(iii) ice	(iii) No details for impact of ice are given. However ice pressure on piers to be taken at 400 lb per sq. in. The thickness and height of ice to be determined by site investigation.		(iii) Dictated by site conditions (*i.e.* size of river, water velocity etc.) **ONTARIO** Article 1.2.17*
13. Any other information supplied.	Clearance. For structures over Interstate Highway System—16 ft clear over the entire width of roadway including shoulders.		

*Articles referred to relate to the A.A.S.H.O. Standard Specifications for Highway Bridges (1961).

}100 lb per sq. ft.

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d by site con- (*i.e.* size of water velocity

1.2.17*

(1961).

FINLAND	FEDERAL REPUBLIC OF GERMANY	GREAT BRITAIN	TURKEY
(i) 4·0 m	(i) —	(i) 6 ft	2.5 m
(ii) (a) 400 kg per m² or 7 ton axle	(ii) No special specification	(ii) (a) 100 lb per sq. ft.	a) 400 kg per m²
(b) —do—		(b) 80 lb per sq. ft.	) 250 kg per m²
(iii) Uniformly distributed load 80 kg per m concentrated load 100 kg (vertical or horizonal).	(iii) Horizontal-80 kg per m	(iii) Between 50 lb and 100 lb per linear foot according to situation. The force to be applied 3 ft above the footway.	100 kg per m
	No specification.	Each case is considered on merits and no standard formulae are used.	—
(i) protection required (ii) 1·0......3·0 t per m (iii) 10......20 t per m solid 10......50 t per m floating			) kg per cm² multi- ied by the area con- ting of the width of e pier and the thick- ss of ice.
		Minimum headroom provided (a) overall roads-16 ft 6 in. (b) In pedestrian subways-7 ft. (c) In cycle or combined cycle and pedestrian subways-7 ft 6 in. (d) In cattle creeps-8 ft For detailed information refer B.S. 153—Girder Bridges Part 3 loads-stresses, Section—A loads, and Ministry of Transport Memorandum No. 771.	

QUESTIONS	INDIA	ITALY	JAPAN	MAL AYSIA
11. Foot bridges.	Clause 116*	No details given.		
(i) The minimum wi of foot bridge acc table.	Shall be designed to resist a lateral horizontal force and a vertical force, each of 100 lb per linear foot applied simultaneously at the top.		(i) 1·5 m	) 6 ft
(ii) The loading speci in the design of deck in			(ii) For urban and rural areas.	i)
(a) Urban areas			(a) 500 kg per m² for deck	(a) 100 lb per ft
(b) Rural areas			(b) 350 kg per m² for main girder	(b) —do—
(iii) Loading stipula for the design hand-rails.		Parapets must not be less than one metre high and should be loaded with a horizontal force of 250 kg per m run applied along the hand-rail.	(iii) 250 kg per m	25-100 lb per linear ause 15, B.S. 153—3A:1954
12. Any formulae st lated for calcula the impact on F and abutments to floating objec the river	No details given.	No details given.		Nil
(i) floating timb			(i)	
(ii) vessels and s river craft			(ii)	
(iii) ice			(iii)	
			(iv) Car—[100 t in car direction, 50 t in other directions at height of 1·2 m	
13. Any other info tion supplied.				

*Articles referr

*Clause referred to relates to the Indian Roads Congress Standard Specifications and Code of Practice for Road Bridges-Sections I & II (1964).

lauses referred
oad Authorities

.N	MALAYSIA	NEW SOUTH WALES	NEW ZEALAND	TURKEY
	i) 6 ft	Clause 2.12* (i) not given	(i) Minimum width between rails to be 6 ft.	(i) 2.5 m
n and rural	)	(ii) same as Q.10(i) & (ii)	(ii)	(ii)
per m² for	(a) 100 lb per ft		(a) Live load 100 lb per sq. ft.	(a) 400 kg per m²
per m² for irder	(b) —do—		(b) Live load 60 lb per sq. ft. (except over motorways)	(b) 250 kg per m²
ıer m	25-100 lb per linear ft ause 15, B.S. 153—Part 3A:1954	(iii) Top members of railings Lateral horizontal force of 150 lb per linear ft and simultaneous vertical force of 100 lb per linear foot applied at top of railing. Lower railing: Lateral horizontal level force for 150 lb per linear ft.	(iii) Lateral load of 60 lb per linear ft applied at top rail level.	(iii) 100 kg per m
	Nil	Clause 2.17*	Not taken into account.	
		(i) Force to be calculated on the assumptions that the log weighs 2 Tons and travels at normal stream velocity. The log shall be stopped in a distance of 1 foot for timber piers, 6 in. for column type piers and 3 in. for solid type concrete piers. Should fender piles or timber sheathing be placed upstream from the pier to absorb the energy of the blow, distances may be increased.		(i) ———
		(ii) No details given.		(ii) ———
[100 t in car on, 50 t in other ons at height of		(iii) —do—		(iii) 30 kg per cm² multiplied by the area consisting of the width of the pier and the thickness of ice.

Specifications and

llauses referred to relate to Highway Bridge Design Specifications of N.A. of A.S. oad Authorities (1965).

QUESTIONS		NORWAY	PHILIPPINES	RHODESIA
11. Foot bridges.	Clau.	So far no specifications adopted.		
(i) The minimum wi of foot bridge acc table.	Sl resist force each foot a at the		(i) 5 ft (clear roadway)	(i) 2 ft 6 in. 8 ft, if combined w cycle track bridge.
(ii) The loading speci in the design of deck in			(ii)	(ii) Section 4 C, I 153/1954 Part 3 tion A
(a) Urban areas			(a) 100 lb per sq. ft.	(a) 50 lb per sq. ft.
(b) Rural areas			(b) —do—	(b) —do—
(iii) Loading stipula for the design hand-rails.			(iii) 150 lb per sq. ft. horizontal force with simultaneous vertical force of 150 lb per sq. ft. applied at the top of railing.	(iii) 500 lb horizontal at 2 ft 6 in. a surface level..
12. Any formulae st lated for calcula the impact on I and abutments to floating objec the river	Nc	So far no specifications adopted.	Velocity of flowing water only considered. $P=KV^2$ where V=Velocity of water in ft per sec. K=a constant which is $1\frac{1}{3}$ for square ends, 1/2 for angle end where the angle is 30 degrees or less and 2/3 for circular pier. P=pressure in lb per sq. ft.	(i) No particular forı adopted. Each ture treated acco to the vegetation predominant in catchment area, heavy large excessive bush, et
(i) floating timl				
(ii) vessels and r river craft				(ii) N/A
(iii) ice				(iii) N/A
13. Any other info tion supplied.				

*Articles referı

*Clai Cod

December 19(

ꝛHODESIA

t 6 in.
t, if combined w
·le track bridge.

ction 4 C, I
3/1954 Part 3
›n A

50 lb per sq. ft.

—do—

00 lb horizontal
t 2 ft 6 in. a
urface level..

No particular for
adopted. Each
ture treated acco
to the vegetation
predominant in
catchment area,
heavy large
excessive bush, et

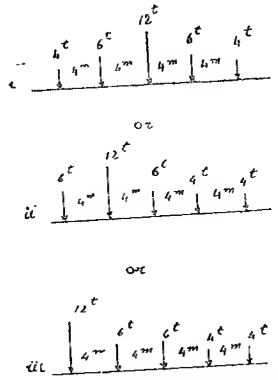
) N/A

i) N/A

SWEDEN	SWITZERLAND	TURKEY
(i) 2.5 m (ii) 400 kg per m^2. In special case, the load may be reduced to 250 kg per m^2. (iii) Transverse live load of 100 kg per m applied at the top of railing.	(i) Not prescribed. (ii) 360 kg per m^2 and one over load of one t. (iii) 120 kg per m in towns 80 kg per m outside the towns.	(i) 2.5 m (ii) (a) 400 kg per m^2 (b) 250 kg per m^2 (iii) 100 kg per m
(i) Nil (ii) Nil (iii) Between 10 and 20 t per m of abutment or pier in question. In flowing water with ice, block pressure parallel to the stream may be assumed between 0·5 to 1·5 t per m of span length and 1/5th thereof perpendicular to the stream.	Not prescribed	(i) —— (ii) —— (iii) 30 kg per cm^2 multiplied by the area consisting of the width of the pier and the thickness of ice.
Vertical clearance (i) Roadway 4·6 m (ii) Cycle track 2·5 m (iii) Foot-path 2 2 m		

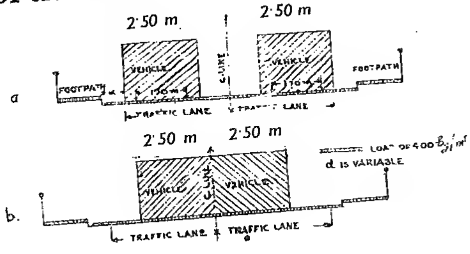
BELGIUM

1. Normal train loading



Over traffic lane 2·50 m^2 minimum wide to 4 m maximum wide and simultaneously a load of 400 kg per m^2 uniformly distributed on the carriageways and footpaths.

2. Lateral disposition of train loading



3. Number of train loadings

One train loading over traffic lane plus a load of 400 kg per m^2.

4. Effective wind pressure

The area of the train of vehicles assumed in elevation is a rectangular screen 2 m high with a length equal to the length of the train.

5. Impact factor

The impact factor due to live loads is the same for in question No. 1—*i*, *ii*, *iii* ; and is given by the following formula :

$$\varphi = 1 + 0.377 \frac{v}{\sqrt{l\alpha}} \sqrt{1 + \frac{2Q}{P}}$$

where

v=speed in kilometre per hour, always greater than 60

l=distance between supports, in metre

$\alpha = \frac{l}{f_s}$

f_s=static deflection, in metre, due to dead weight

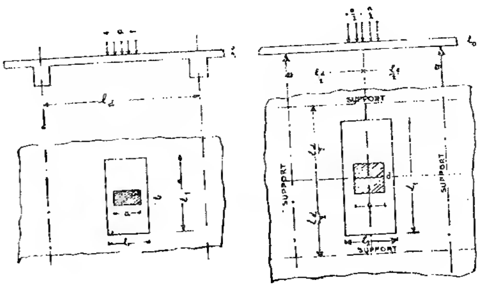
Q =moving loads on the bridge deck, in tonnes

P=deadweight of the bridge, in tonnes

6. **Ground contact area**

Slab bearing in one direction

Slab bearing on four sides



$$l_1 = b + 2h_0 + \frac{ld}{3}$$

$$l_2 = a + 2h_0$$

$$l_1 = a + 2h_0 + \frac{ld}{2 \cdot 5}$$

$$l_2 = a + 2h_0$$

ld=span of the slab
h_0=width of the slab

7. **Equivalent U.D.L.**

There are no regulations.

8. **Braking force**

The braking force is equal to 1/20 of the load 400 kg per m² (without impact factor) distributed on the entire surface of the bridge deck or, if it is more unfavourable, 3/10 of the wheel loads placed on the deck.

9. **Surcharge effect**

The surcharge effect considered in the design of abutments of the bridge is equal to the live loads considered for calculating the bridge.

10. **Footpath loading**

crowd load=400 kg per m² with impact factor
minimum width : 1 metre
special loading : 1000 kg situated at 40 cm from the hand-rails.

11. **Footbridges**

(*i*) no regulations
(*ii*) loading 400 kg per m² for urban and rural areas
(*iii*) a horizontal and transverse load of 100 kg per metre run on the hand-rails.

12. **Impact due to floating objects**

(*i*) no regulations
(*ii*) the impact is equal to 5% of the weight of vessels and it is assumed to have an influence 1 m above the water level.
(*iii*) no regulations.

TABLE 1

TABLE OF EQUIVALENT HEIGHTS (H) OF SURCHARGE OF EARTH

Depth of abutment below the road level in feet	*H* in feet for the concentrated surface loads due to the wheel or track loads of the following I.R.C. Standard Loadings					
	I.R.C. CLASS AA LOADING		I.R.C. CLASS A LOADING		I.R.C. CLASS B LOADING	
	Single-lane bridges	Multi-lane bridges	Single-lane bridges	Multi-lane bridges	Single-lane bridges	Multi-lane bridges
1	84.6	50.8	46.8	56.4	28.2	33.8
2	65.3	39.2	36.1	43.5	21.8	26.1
3	51.6	31.0	28.6	34.4	17.2	20.6
4	42.9	25.7	23.7	28.6	14.3	17.2
5	36.9	22.1	20.4	24.6	12.3	14.8
6	32.6	19.5	18.0	21.7	10.9	13.0
7	29.1	17.5	16.1	19.4	9.7	11.6
8	26.4	15.8	14.6	17.6	8.8	10.6
9	24.1	14.5	13.4	16.1	8.1	9.7
10	22.4	13.4	12.4	14.9	7.5	8.9
12	19.4	11.6	10.7	12.9	6.5	7.7
14	17.1	10.3	9.5	11.4	5.7	6.8
15	16.2	9.7	9.0	10.8	5.4	6.5
16	15.3	9.2	8.5	10·2	5.1	6.1
18	13.8	8.3	7.6	9.2	4.6	5.5
20	12.6	7.6	7.0	8.4	4.2	5.0
22	11.6	6.9	6.4	7.7	3.9	4.6
24	10.8	6.5	6.0	7.2	3.6	4.3
25	10.4	6.2	5.7	6.9	3.5	4.1
26	10.1	6.0	5.6	6.7	3.4	4.0
28	9.5	5.7	5.2	6.3	3.2	3.8
30	8.9	5.3	4.9	5.9	3.0	3.5
32 and above	8.4	5.0	4.6	5.6	2.8	3.4

Note :—The above figures are based on the following values for the constants for the abutments and the backfill :

(1) Length of abutment (L) = 15 ft for single-lane bridges and 25 ft for multi-lane bridges.

(2) Angle of internal friction of the backfill (ϕ) = 30°

(3) Wt of backfill (W).........100 lb per cu. ft.

(4) The resultant earth pressure acts in a horizontal direction.

For different values, say, L_1, ϕ_1 and W_1 for the constants, the figures given in the above Table should be multiplied by the following factors :

$$\frac{L\ (15 \text{ or } 25 \text{ as the case may be})}{L_1}\ ;\ \frac{(1+\sin\phi_1)}{3(1-\sin\phi_1)} \text{ and } \frac{100}{W_1} \text{ respectively.}$$

TABLE 2—**Equivalent Distributed Load**

(From Bridge Loadings—Italy)

Span	*Bending load in t/ml*				
	Civil Loading		*Military Loading*		
	Type 1	*Type* 2	*Type* 4	*Type* 5	*Type* 6
m					
1	16.000	24.000	28.000	10.667	38.000
1.5	10.667	16.000	18.667	9.027	25.333
2	8.000	12.000	15.541	8.188	19.981
2.5	6.400	9.600	14.193	7.285	18.248
3	5.333	8.000	12.859	7.329	16.534
3.5	4.571	6.857	11.677	7.561	15.013
4	4.000	6.000	10.658	7.455	13.703
4.5	3.556	5.333	9.784	7.252	12.579
5	3.200	4.800	9.032	7.143	11.612
5.5	2.921	4.382	8.381	6.954	10.776
6	2.778	4.167	7.814	6.727	10.047
6.5	2.651	3.965	7.316	6.486	9.407
7	2.612	3.778	6.877	6.243	8.842
7.5	2.560	3.605	6.486	6.005	8.839
8	2.500	3.445	6.136	5.776	7.889
8.5	2.436	3.297	5.990	5.559	7.728
9	2.370	3.160	5.854	5.352	7.561
9.5	2.305	3.031	5.713	5.157	7.387
10	2.240	2.916	5.599	4.974	7.209
11	2.128	2.705	5.411	4.639	6.857
12	2.111	2.521	5.206	4.342	6.518
13	2.083	2.360	4.997	4.231	6.200
14	2.122	2.217	4.793	4.137	5.933
15	2.133	2.091	4.597	4.110	5.710
16	2.125	1.978	4.420	4.106	5.521
17	2.104	1.876	4.340	4.120	5.357
18	2.086	1.784	4.291	4.136	5.195
19	2.083	1.701	4.230	4.204	5.638
20	2.080	1.625	4.159	4.253	4.885
21	2.068	1.555	4.113	4.293	4.739
22	2.050	1.491	4.060	4.308	4.599
23	2.028	1.432	4.000	4.304	4.475
24	2.028	1.378	3.936	4.286	4.363
25	2.022	1.327	3.870	4.257	4.255
26	2.036	1.280	3.818	4.220	4.151
27	2.041	1.236	3.790	4.177	4.051
28	2.041	1.196	3.766	4.145	3.954
29	2.036	1.157	3.737	4.118	3.860
30	2.031	1.121	3.703	4.106	3.771
31	2.031	1.088	3.666	4.104	3.685
32	2.031	1.056	3.626	4.105	3.602
33	2.028	1.026	3.584	4.110	3.522
34	2.021	0.997	3.567	4.125	3.446
35	2.012	0.971	3.567	4.137	3.372
36	2.012	0.945	3.583	4.157	3.302
37	2.010	0.921	3.612	4.169	3.233
38	2.017	0.898	3.634	4.174	3.168
39	2.020	0.876	3.648	4.173	3.105
40	2.020	0.856	3.657	4.167	3.044
45	2.015	0.765	3.673	4.107	2.771
50	2.010	0.691	3.658	4.116	2.541
55	2.010	0.631	3.646	4.138	2.345
60	2.004	0.580	3.621	4.107	2.177
70	2.005	0.500	3.570	4.124	1.903
80	2.005	0.439	3.602	4.104	1.689
90	2.003	0.391	3.597	4.107	1.518
100	2.003	0.353	3.577	4.112	1.379
120	2.001	0.295	3.583	4.107	1.164
140	2.002	0.253	3.570	4.103	1.007
160	2.001	0.222	3.577	4.104	0.887
180	2.000	0.198	3.572	4.106	0.793
200	2.001	0.178	3.571	4.086	0.717

Span	*Shear load in t/ml*				
	Civil Loading		*Military Loading*		
	Type 1	*Type* 2	*Type* 4	*Type* 5	*Type* 6
m					
1	16.000	24.000	28.000	12.160	36.000
1.5	10.667	16.000	24.640	10.287	31.680
2	8.000	12.000	20.860	9.787	26.820
2.5	6.400	9.600	17.830	9.114	22.925
3	5.333	8.000	15.493	8.770	19.920
3.5	4.898	7.347	13.669	8.620	17.574
4	4.500	6.750	12.215	8.400	15.705
4.5	4.148	6.222	11.034	8.217	14.187
5	3.840	5.760	10.058	7.936	12.931
5.5	3.570	5.355	9.497	7.617	12.229
6	3.333	5.000	9.147	7.289	11.803
6.5	3.314	4.686	8.788	6.968	11.359
7	3.265	4.408	8.434	6.661	10.917
7.5	3.200	4.160	8.094	6.372	10.487
8	3.125	3.938	7.770	6.133	10.077
8.5	3.045	3.737	7.464	5.950	9.687
9	2.963	3.556	7.258	5.813	8.401
9.5	2.925	3.391	7.057	5.717	9.125
10	2.880	3.240	6.877	5.639	8.873
11	2.777	2.975	6.609	5.554	8.474
12	2.667	2.750	6.331	5.511	8.079
13	2.651	2.556	6.057	5.453	7.700
14	2.612	2.388	5.809	5.355	7.358
15	2.560	2.240	5.607	5.234	7.072
16	2 531	2.109	5.408	5.117	6.798
17	2.491	1.993	5.216	5.032	6.537
18	2.444	1.889	5.098	4.982	6.291
19	2.438	1.795	5.051	4.958	6.059
20	2.420	1.710	5.006	4.944	5.840
21	2.395	1.633	4.947	4 920	5.635
22	2.380	1.562	4.877	4.879	5.443
23	2.359	1.497	4.829	4.827	5.261
24	2.333	1.438	4.795	4.778	5.091
25	2.330	1.382	4.750	4.742	4.930
26	2.320	1.331	4.702	4.720	4.778
27	2.305	1.284	4.664	4.709	4.635
28	2.296	1.240	4.634	4.702	4.500
29	2.283	1.199	4.600	4.688	4.372
30	2.267	1.160	4.559	4.665	4.251
31	2.264	1.124	4.515	4.635	4.137
32	2.258	1.090	4.477	4.608	4.028
33	2.248	1.058	4.436	4.591	3.924
34	2.242	1.028	4.391	4.578	3.825
35	2.233	0.999	4.357	4.571	3.732
36	2.222	0.972	4.340	4.568	3.642
37	2.221	0.947	4.330	4.558	3.557
38	2.216	0.922	4.314	4.543	3.475
39	2.209	0.899	4.294	4.523	3.397
40	2 205	0.878	4.276	4.508	3.323
45	2.181	0.782	4.212	4.475	2.993
50	2.163	0.706	4.135	4.429	2.722
55	2.147	0.643	4.079	4.400	2.496
60	2.133	0.590	4.041	4.380	2.304
70	2.116	0.507	3.962	4.337	1.997
80	2.101	0.444	3.923	4.306	1.762
90	2.089	0.396	3.878	4.286	1.576
100	2.079	0.356	3.849	4.268	1.426
120	2.061	0.298	3.799	4.239	1.197
140	2.051	0.255	3.765	4.220	1.031
160	2.043	0.224	3 741	4.205	0.906
180	2.037	0.199	3.722	4.190	0.808
200	2.033	0.179	3.707	4.179	0.729

N.B. For any intermediate span, linear interpolation is to be made.

1965

loads of

SS B
G

ulti-lane
bridges

33.8
26.1
20.6
17.2
14.8
13.0
11.6
10.6
9.7
8.9
7.7
6.8
6.5
6.1
5.5
5.0
4.6
4.3
4.1
4.0
3.8
3.5
3.4

its and the

ridges.

above Table

UNITED STATES OF AMERICA

PLATE I

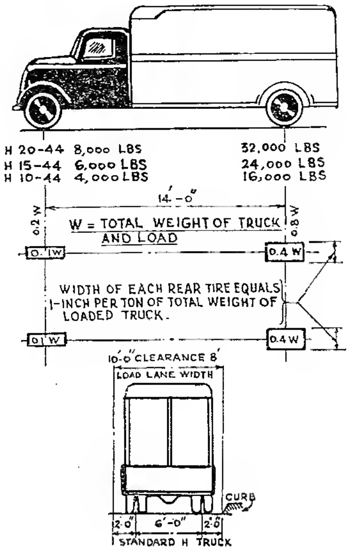


Fig. 1.

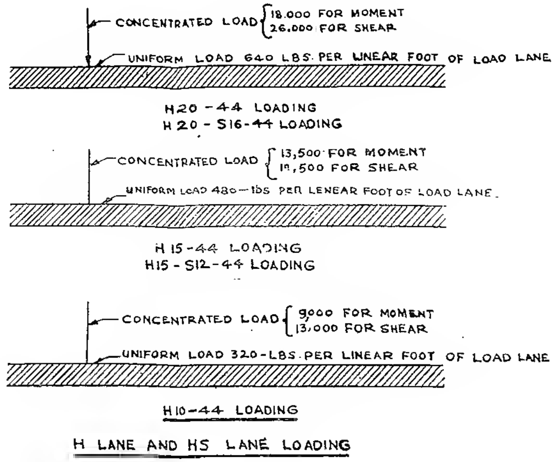


Fig. 2.

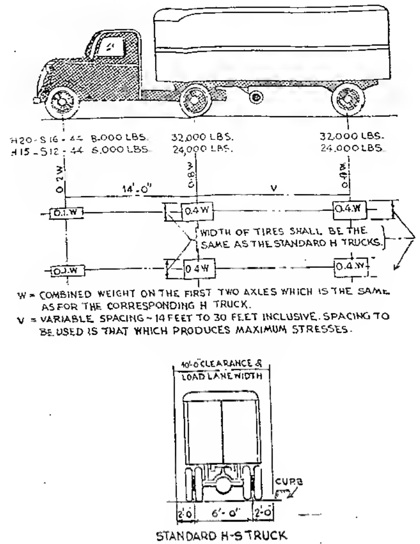
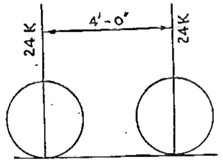


Fig. 3.



2- 24 KIP AXLES.

Fig. 4.

Military loading for bridges on the Interstate System

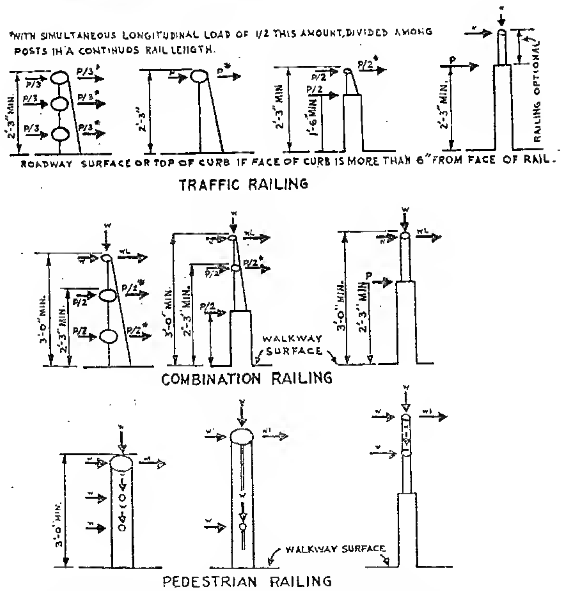


Fig. 5. **LEGEND**

P=10,000 lb. L=Post Spacing for Traffic Railing. W=50 lb P.L.F. I=Post Spacing for Pedestrian Railing. Rail Load shown Left. Post Load shown Right

Note. The shapes of Rail Members are illustrative only. Any Material or combination of Materials listed in Article 1.1.10(A) may be used in any Configuration

AUSTRIA

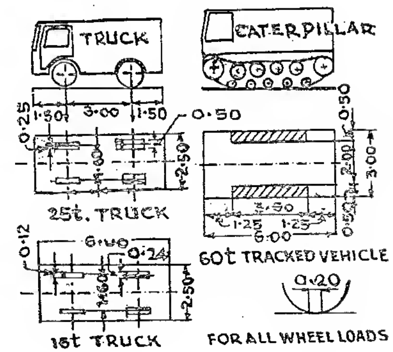


Fig. 6.

PLATE II

FEDERAL REPUBLIC OF GERMANY

Dimensions of Design Vehicle (in Metre)

Heavy Truck (SLW) Truck (LKW)

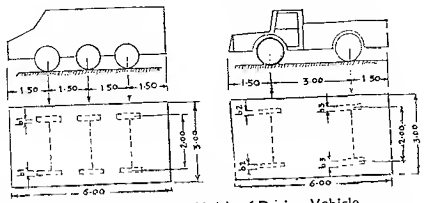


Table 2. Load and Contact Width of Design Vehicle

HEAVY TRUCKS (SLW)				TRUCK (LKW)					
1	2	3	4	5	6	7	8	9	10
						Front Wheels		Rear Wheels	
Class	Total Load t	Wheel Load t	Width of Contact b_1	Class	Total Load t	Wheel Load t	Width of Contact b_2	Wheel Load t	Width of Contact b_3
60	60	10.0	0·60	16[5*]	16	3·0	0·26	5·0	0·40
30	30	5·0	0·40	6	6	1·0	0·14	2·0	0·20
INTERMEDIATE CLASS (only for Checking the Existing Bridges)									
45	45	7·50	0·50	12	12	2·0	0·29	4·0	0·30
24	24	4·0	0·30	9	9	1·5	0·18	3·0	0·26
				3	3	0·5	0·14	1·0	0·20

Contact Length of Wheel Load in the Direction of Travel 0·2m, Contact Area of each Wheel $=0{\cdot}20\times$Contact Width (in Metre^2).

Table 3

1	2	3	4	5	6	7
	Main Lane considered in Calculation Width=3m					
Class	DESIGN VEHICLE			Uniformly Distributed Wheel Load 'p' t/m^2	Uniformly Distributed Wheel Load 'p' in the Area outside the main Lane t/m^2	TYPE OF ROAD
	Abbreviation	Total Load t	Substitute Load t/m^2			
60	SLW	60	3·33	0·50	0·30	Fed. Autobahn Fed. H. Way Rural H. Way I. State H. Way
30	SLW	30	1·67	0·50	0·30	Rural H. W. (II), Dist. Road Municipal Roads
16[5*]	LKW	16	0·89	0·50	0·30	Municipal Road Agricultural Tracks
6	LKW	6	0·40	0·40	0·20	Agricultural Tracks with Light Traffic
Design Load for Intermediate Class (only for Checking the Existing Bridges)						
45	SLW	45	2·50	0·50	0·30	
24	LKW	24	1·33	0·50	0·30	
12	LKW	12	0·67	0·40	0·30	
9	LKW	9	0·50	0·40	0·30	
3	LKW	3	0·30	0·30	0·20	

In the case of Bridge Class 30 the Girders and Intermediate Cross Girders both upto a spacing of 2·0m Longitudinal Girders and Plates with supported Width upto 7m are to be designed for an Axle Load of 13T, the Lane Widths of Wheel are 2m and 4m respectively.

*In calculations, distribution of loads (Front Wheel÷Rear Wheel) should be taken as 1 : 2.

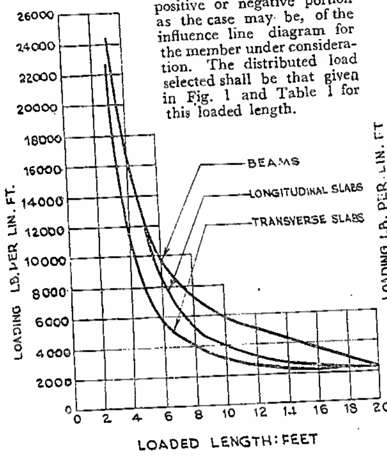
Fig. 7.

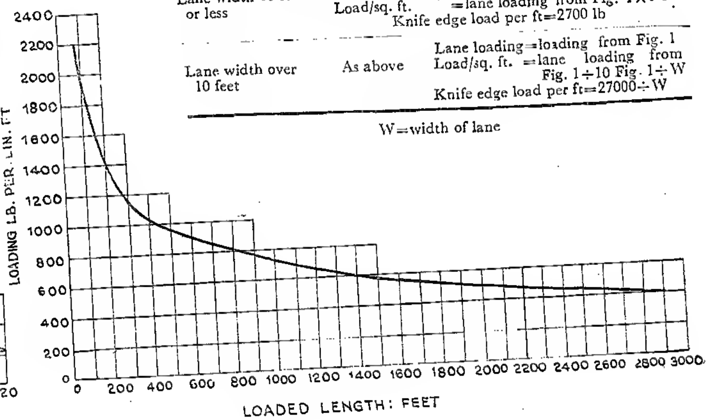
GREAT BRITAIN

	Slabs	Beams
Lane width 10 ft or less	Lane loading Load/sq. ft.	=loading from Fig. 1×W/10 =lane loading from Fig. 1×0·1 Knife edge load per ft=2700 lb
Lane width over 10 feet	As above	Lane loading=loading from Fig. 1 Load/sq. ft. =lane loading from Fig. 1÷10 Fig. 1÷W Knife edge load per ft=27000÷W

W=width of lane

The loaded length is the length of the base of the positive or negative portion as the case may be, of the influence line diagram for the member under consideration. The distributed load selected shall be that given in Fig. 1 and Table 1 for this loaded length.



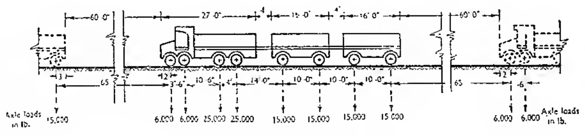


LOADING CURVE FOR TYPE 'HA' LOADING.

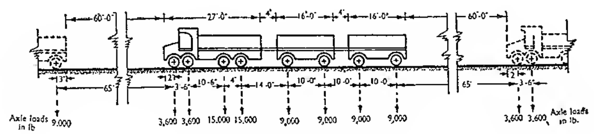
Fig 8.

Figs. and Tables referred to above relate to British Standard Highway Loadings, B.S. 153 : Part 3, Section A—1954

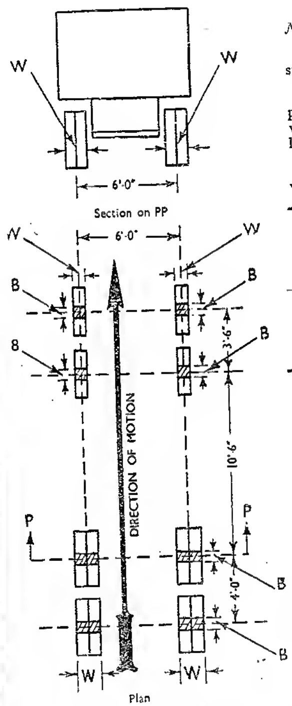
INDIAN ROADS CONGRESS BRIDGE LOADINGS



Class A train of vehicles



Class B Train of Vehicles



Class A train of vehicles
Driving vehicle
(Clause 207.1)

Notes :

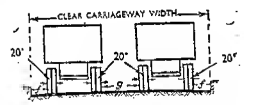
1. The nose to tail distance between successive trains shall be 60 feet.

2. No other live load shall cover any part of the carriageway when a train of vehicles (or trains of vehicles in a multi-lane bridge) is crossing the bridge.

3. The ground contact area of the wheels shall be as under :

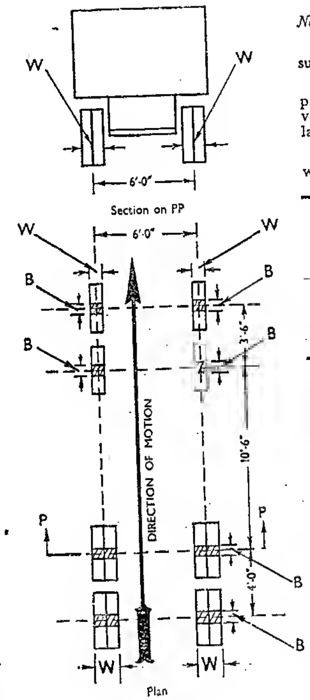
Axle load lb	Ground contact area	
	B in inches	W in inches
25,000	10	20
15,000	8	15
6,000	6	8

4. The minimum clearance, *f*, between the outer edge of the wheel and the roadway face of the kerb, and the minimum clearance, *g*, between the outer edges of passing or crossing vehicles on multi-lane bridges shall be as given below :



Clear carriageway width	*g*	*f*
18 ft to 24 ft	Uniformly increasing from 1 ft 4 in. to 4 ft	6 in. for all carriageway widths
Above 24 ft	4 ft	

Fig. 10.



Class B train of vehicles
Driving vehicle
(Clause 207.1)

Notes :

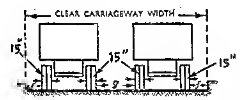
1. The nose to tail distance between successive trains shall be 60 ft.

2. No other live load shall cover any part of the carriageway when a train of vehicles (or trains of vehicles in a multi-lane bridge) is crossing the bridge.

3. The ground contact area of the wheels shall be as under :

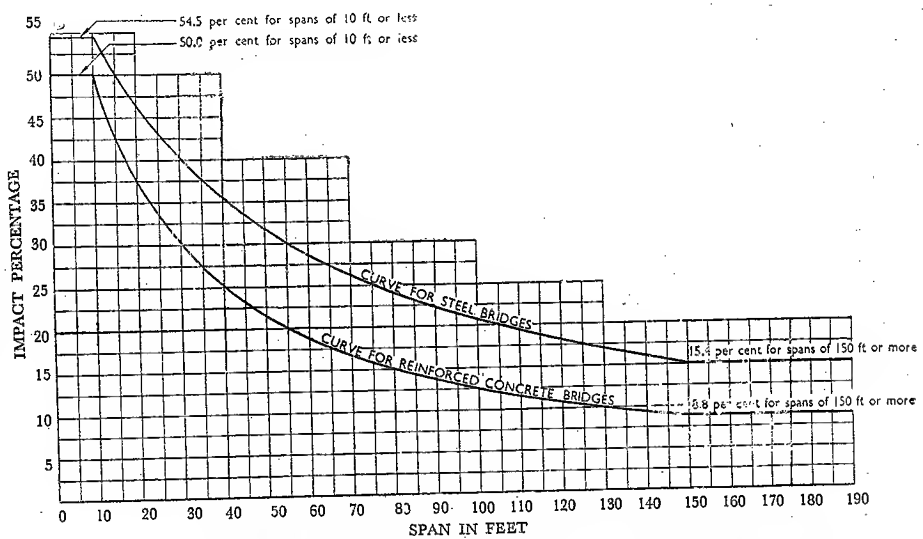
Axle load lb	Ground contact area	
	B in inches	W in inches
15,000	8	15
9,000	6	12
3,600	5	7

4. The minimum clearance, *f*, between the outer edge of the wheel and the roadway face of the kerb, and the minimum clearance, *g*, between the outer edges of passing or crossing vehicles on multi-lane bridges shall be as given below :



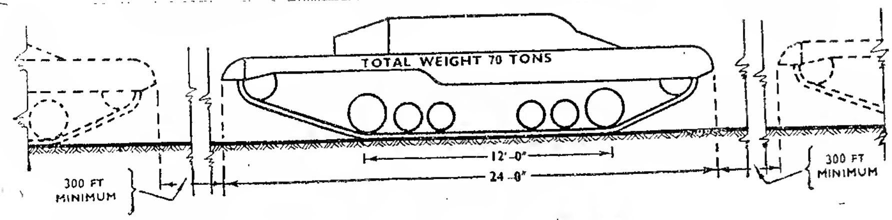
Clear carriageway width	*g*	*f*
18 ft to 24 ft	Uniformly increasing from 1 ft 4 in. to 4 ft	6 in. for all carriageway widths
Above 24 ft	4 ft	

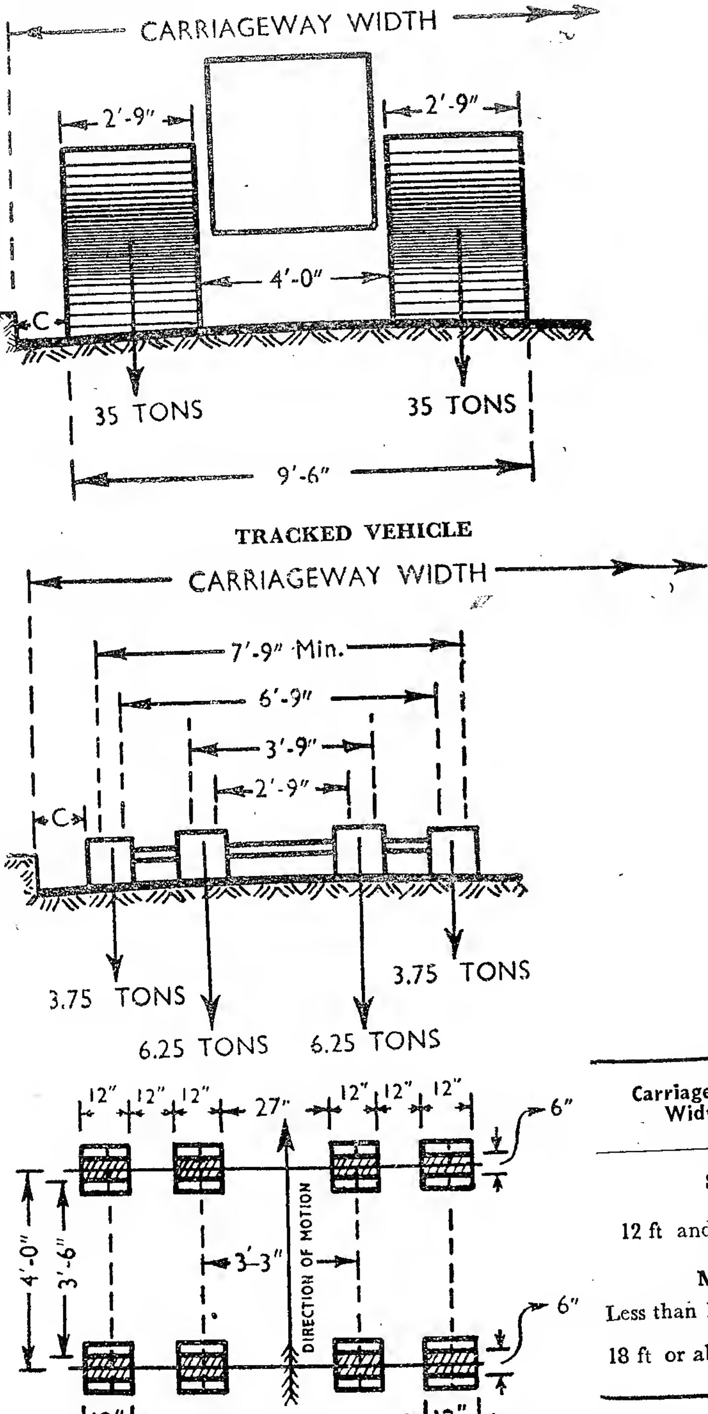
Fig. 11.



Impact percentage Curves for Highway Bridges for class A and class B loadings
(Clause 211.2)

Fig. 12.





Plan : **WHEELED VEHICLE**

Class AA tracked wheeled vehicles (Clause 207·1)

Fig. 9.

Notes :

1. The nose to tail spacing between two successive vehicles shall not be less than 300 ft.

2. For multi-lane bridges and culverts, one train of Class AA tracked or wheeled vehicles, whichever creates severer conditions shall be considered for every two-traffic-lane width.

No other live load shall be considered on any part of the said 2-lane width carriageway of the bridge when the above mentioned train of vehicles is crossing the bridge.

3. The maximum loads for the wheeled vehicle shall be

20 tons for a single axle, or 40 tons for a bogie of two axles spaced not more than 40 ft centres.

4. The minimum clearance between the road face of the kerb and the outer edge of the wheel or track, C, shall be as under :

Carriageway Width	Minimum Value of C
Single Lane Bridges	
12 ft and above	1 ft-0 in.
Multiple Lane Bridges	
Less than 18 ft	2 ft-0 in.
18 ft or above	4 ft-0 in.

PLATE IV

ITALY
CIVIL LOADING

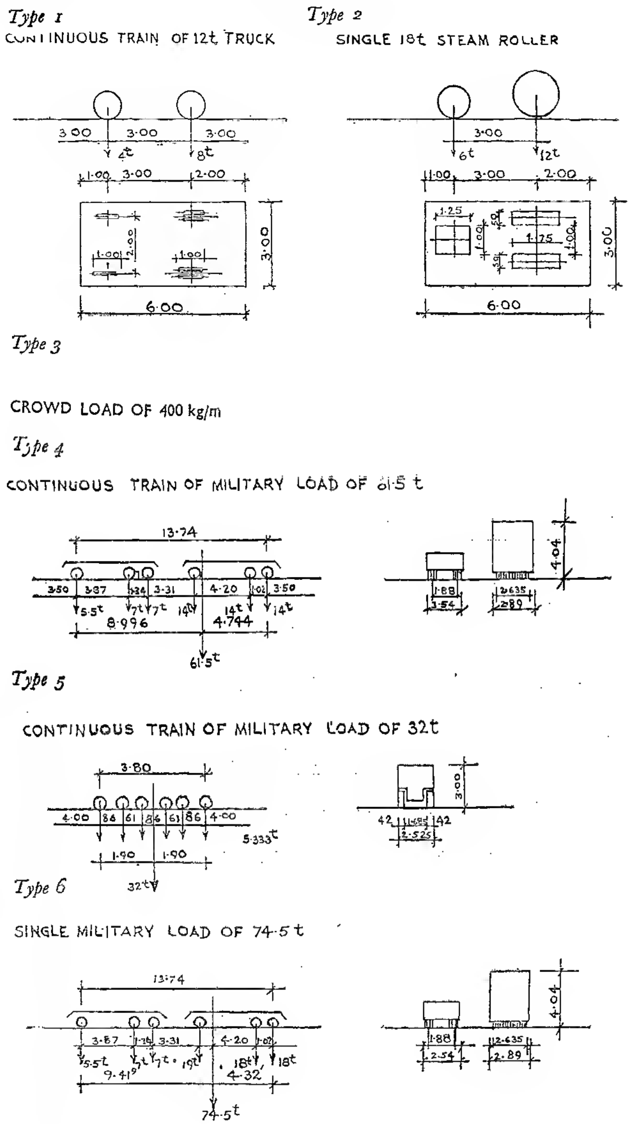


Fig. 13

PHILIPPINES

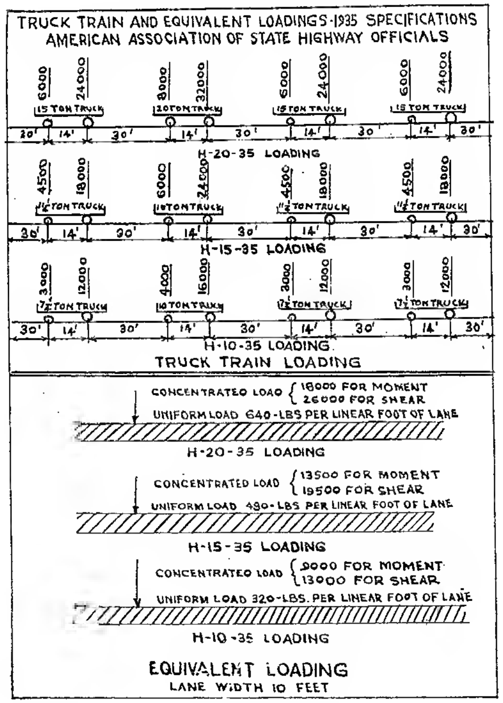


Fig. 14.

SWEDEN

TRAFFIC LOADING FOR BRIDGES

Cl. Lane Loading

1. One=14T Axle-Load Plus Distributed Load P t/m.

P=14t

L<10 p=2·4

L=10–90 $p=2{\cdot}4-\frac{13(L-10)}{80}$

L>90 p=1·1

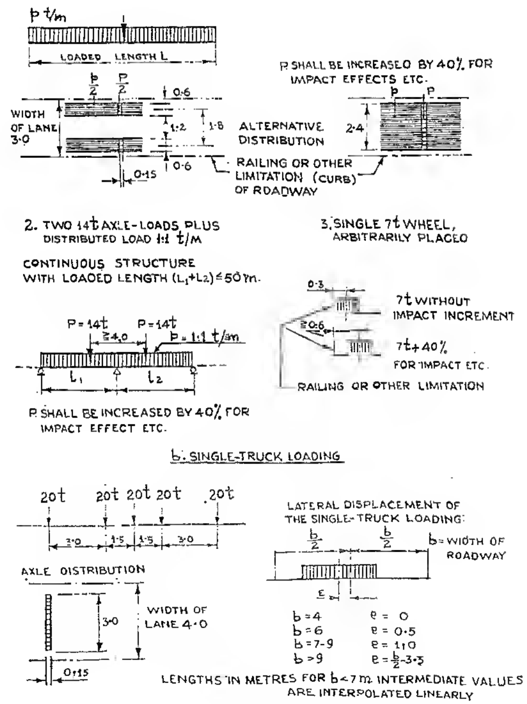
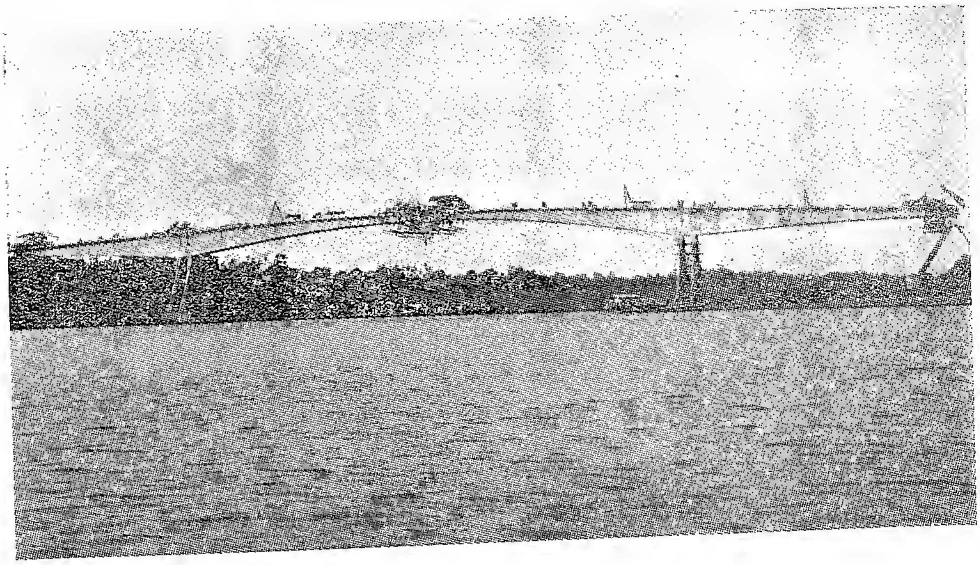


Fig. 15.



BARAK BRIDGE

When completed this bridge will have the largest prestressed span of any bridge so far built in India.

The bridge will be 924 ft. long with deckings of 77 ft.—185 ft.—400 ft.—185 ft.—77 ft. span, providing a 24 ft. wide roadway. This "Cantilever" in-situ construction was done without staging, which ensured navigation during construction.

Prestressing has been done by the Freyssinet method.

Designed and constructed to the orders of the Chief Engineer (Roads) P.W.D., Shillong, Assam.

By

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